Groundwater Monitoring Program

Annual Update

ELMENDORF AIR FORCE BASE, ALASKA

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Elmendorf Air Force Base (AFB) has implemented a comprehensive strategy to clean up contaminated groundwater on base and to ensure these cleanup efforts are protective of human health and the environment. The cleanup strategy is divided into three major elements:

- monitored natural attenuation of groundwater,
- natural and man-made wetlands adjacent to Ship Creek, and
- land use controls.

The purpose of this fact sheet is to describe each component of the groundwater cleanup strategy and detail how they contribute to the long term safety of the water migrating from the base.

Background

As part of the cleanup process, Elmendorf AFB has implemented a comprehensive groundwater monitoring strategy that prioritizes individual plumes of groundwater contamination based on the risk they present to environmental receptors. This approach allows remedial assets to aggressively target problematic plumes while plumes of a less threatening nature may be studied to formulate an efficient and economical remedial method for these locations. The current focus of groundwater monitoring activities at Elmendorf AFB is on plumes located on the southern boundary near Ship Creek.

Groundwater

The base has an upper and lower aquifer, which are basically layers of water-saturated soil. An impermeable layer of silt and clay separates the aquifers. The deep groundwater aquifer under the silt and clay formation on base is not contaminated. This lower aquifer supplies water for industrial purposes, for the power plant, and for the fish hatchery.

The upper aquifer, also known as the shallow aquifer, is located 10 to 50 feet below the surface of the ground and has several individual plumes of contamination. These contaminated plumes are the result of accidental fuel spills or past industrial practices that are no longer allowed. While cleanup efforts and natural cleansing processes take place, Elmendorf monitors the water to ensure that people and the environment are protected. The plumes are getting smaller and Elmendorf environmental managers expect the base groundwater will be clean within about 20 years. The contaminated groundwater does not affect any drinking water on or off the base.

Monitored Natural Attenuation

Natural attenuation breaks down contaminants in groundwater through biological, chemical and physical processes. A basewide program to monitor the effectiveness of natural attenuation has been implemented and ongoing for seven years. The monitoring program has been designed to ensure that overall basewide groundwater concerns are addressed. It also makes sure the remedies taken are protective of human health and the environment.

This program involves sampling approximately 60 groundwater monitoring wells and/or seeps at varying intervals throughout the year. Results are evaluated and appropriate adjustments are made to the program. If new or increased contamination is found and validated by follow-up tests, additional wells are added to the monitoring program. Monitoring in some wells may be stopped if those wells are no longer needed for the protection of human health and the environment. These decisions are based on criteria established by the Air Force, the Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC).

Site investigations completed in the 1990s and findings from the groundwater monitoring program helped delineate several plumes of contamination that contain trichloroethene (TCE), a degreasing solvent, and/or benzene, a fuel constituent. TCE and benzene are closely monitored under EPA and ADEC regulations.

The plumes are primarily located in the industrial area of the base and are generally moving southward towards Operable Unit (OU) 5 and Ship Creek. Four plumes (Kenney Avenue Plume, Fairchild Avenue Plume, Slammer Avenue Plume and LF59-MW-03 Plume) are in the vicinity of Ship Creek and are shown on Figure 1. Also portrayed on this figure

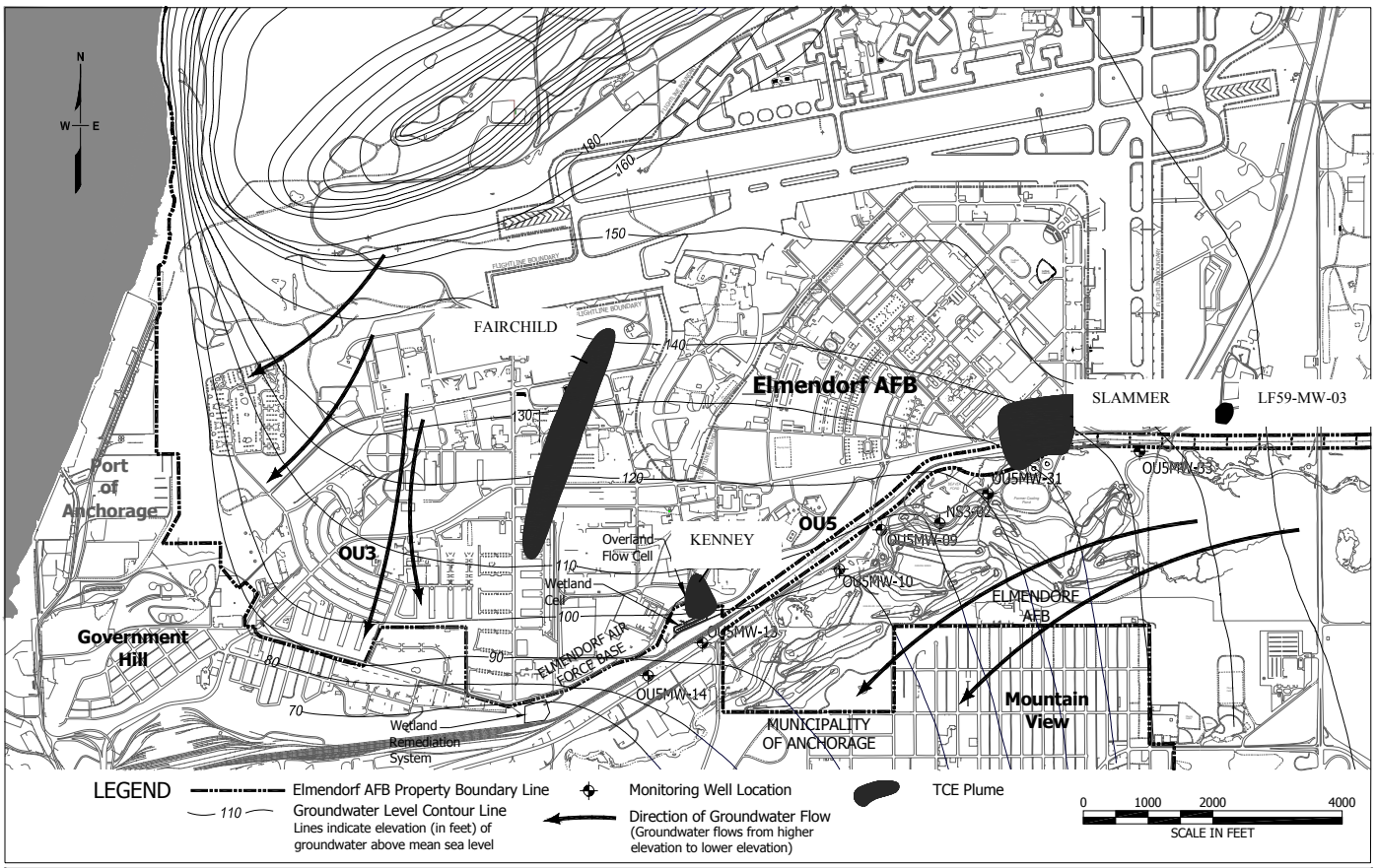

Figure 1 – Map of Elmendorf Air Force Base depicting sentinel wells in the monitoring program, groundwater flow directions and elevations, and base boundaries.

Table 1 – Sentinel Groundwater Monitoring Well Results Along Ship Creek

Monitoring Well	Contaminant	Maximum Concentration Observed[A] (ug/L)	Current Concentration[B] (ug/L)
OU5MW-09	TCE	ND	ND(0.18)
	Benzene	0.1	ND(0.072)
OU5MW-10	TCE	ND	ND(0.18)
	Benzene	0.1	ND(0.072)
OU5MW-13	TCE	0.9	ND(0.18)
	Benzene	3.7	0.84
OU5MW-14	TCE	0.2	ND(0.18)
	Benzene	0.1	ND(0.072)
OU5MW-31	TCE	4.2	1
	Benzene	0.4	ND(0.072)
OU5MW-33	TCE	1.1	0.51
	Benzene	ND	ND(0.072)
NS3-02	TCE	**5.5**	3.3
	Benzene	1.8	ND(0.072)

Notes:
A: This is the maximum observed concentration since 1992.
B: Sample results collected in December, 2003.
All units are expressed as micrograms per liter (ug/L).
Bold cells are above regulatory criteria.
ND: Not detected above the method detection limit (in parentheses).
Target date to meet cleanup levels is October 2025.
TCE = Trichloroethylene or trichloroethene.
The cleanup level for benzene and TCE is 5 µg/L.
The cleanup levels were taken from 40 CFR 131 and 18 AAC 75.341 under 40-inch, migration to groundwater standards.

are seven sentinel wells used to monitor the migration of contaminants near Ship Creek. TCE and benzene concentrations in these sentinel wells have been detected at very low levels and groundwater monitoring data collected through the end of 2003 has confirmed natural attenuation is generally reducing the size of the plumes and levels of contamination. Current levels are below applicable cleanup criteria and show a marked decrease over time from the historically high levels observed during earlier monitoring activities (Table 1).

Wetland Remediation System

During the site investigations, Elmendorf AFB discovered several groundwater seeps within OU5 that were contaminated with TCE. The sources of this contamination were the upgradient groundwater plumes located on Elmendorf AFB. The seeps in the eastern area of OU5 flow into a beaver pond where natural attenuation degrades the contamination before it reaches Ship Creek. To prevent any contamination from reaching Ship Creek, the Air Force leased land from the Alaska Railroad Corporation and designed and built a wetland remediation system in 1996-1997.

This "engineered" wetland is at the base of the bluff overlooking Post Road (Figure 2). It works in conjunction with nearby marshy areas to capture contaminated water as it leaves the aquifer at seeps in the bluff. The water is collected by wells and pumped up to the top of the bluff where some of the contaminants naturally dissipate as the water flows through a shallow, gravel-filled trough. The water then flows down to the wetland. Using the same natural processes which occur in the Beaver Pond, plants and microorganisms in the wetland's multi-channeled water maze naturally remove any remaining contaminants before the cleaned water is discharged to Ship Creek. The system, which operates year-round, treats approximately 40 million gallons of contaminated groundwater per year. To confirm the quality of the water leaving the wetland, the Air Force collects samples every three months.

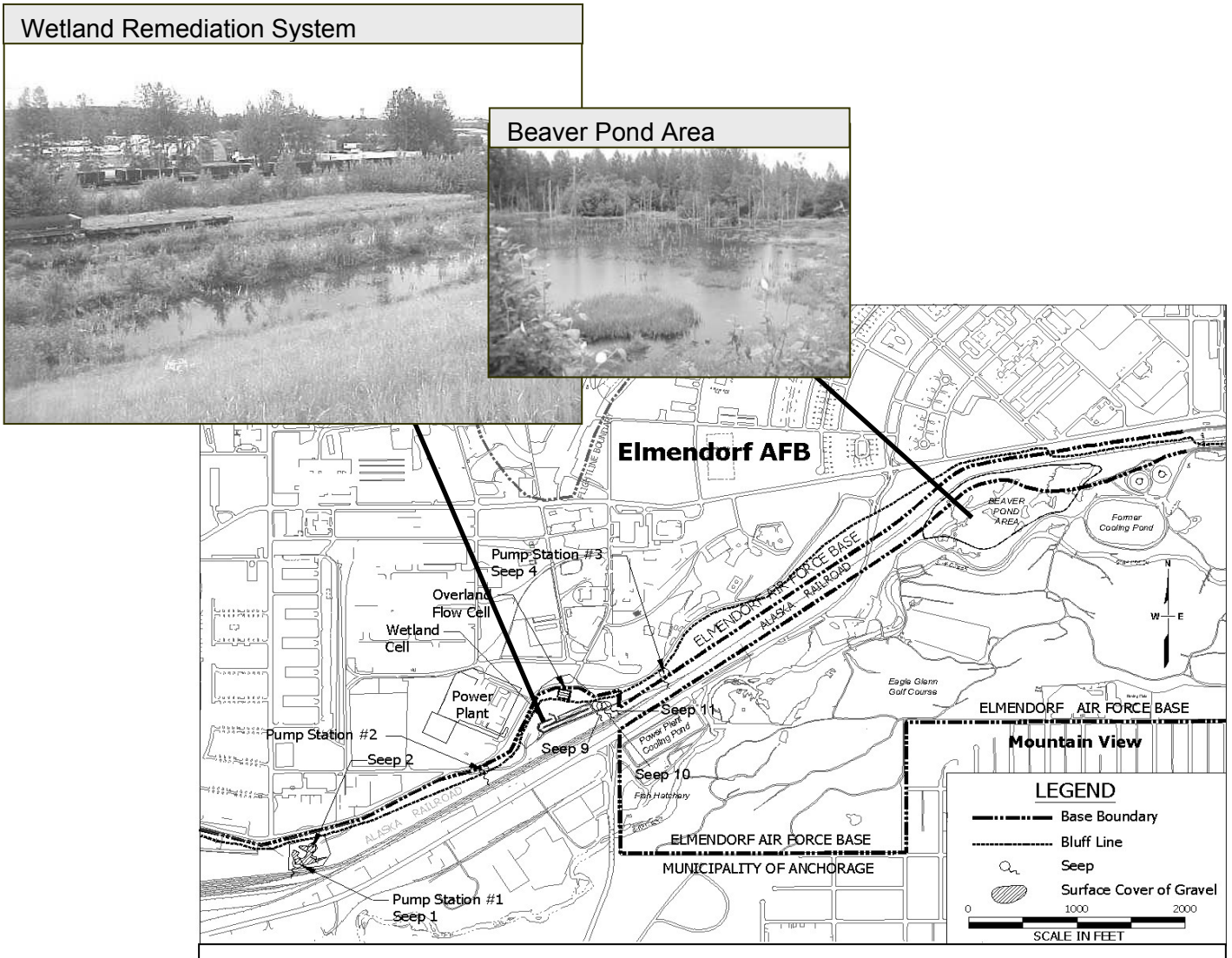

Figure 2 – Map showing OU5 Wetland Remediation System.

All samples of this water have been clean. In addition, water samples are taken from Ship Creek twice per year, and have also all been clean.

Elmendorf also periodically samples other groundwater seeps on the bluff above Ship Creek. In 2001, this monitoring revealed TCE in three additional groundwater seeps. These seeps (9, 10 and 11) are shown on Figure 2. The TCE was found at levels slightly above cleanup standards. However, downgradient sampling results suggested that this newly discovered TCE is able to naturally attenuate within a few yards of leaving the bluff.

The Elmendorf restoration team is investigating the source of the TCE groundwater seeps. These seeps will continue to be monitored and in 2004, construction will begin on a system to collect Seeps 9, 10 and 11 and treat them in the existing wetland remediation system.

Land Use Controls

Land use controls are selected as part of the cleanup remedy at locations where contamination remains at levels that prevent unrestricted and unlimited use of the site. The purpose of land use controls is to prevent exposure to contaminated soil or groundwater. On Elmendorf AFB, land use controls include restricted use areas such as old landfills and a basewide prohibition on the use of groundwater from the shallow aquifer south.

To ensure compliance with land use controls, Elmendorf's Environmental Flight reviews all excavation requests and new project designs proposed for the base. The Environmental Flight also monitors land use control compliance by base tenants and leaseholders. The land use controls controls are described in detail in the *Land Use Controls Management Plan*. This document is available at the Elmendorf Information Repositories described on the last page of this program update.

Potential Pathways/Receptors

Land use controls currently prohibit the use of groundwater from the shallow aquifer. The only outlet for this groundwater is at the seeps on the bluff above Ship Creek where it is released from the soil in limited amounts as surface water. This water is being collected and treated in the wetland remediation system, thereby mitigating the exposure pathways presented by these seeps.

Future Activities

Future activities conducted under the groundwater monitoring program will include the expansion of the wetland remediation system. This will increase its impact and allow it to capture three new seeps coming from the bluff above Ship Creek.

Monitoring will continue at these plumes near Ship Creek in addition to those on the interior of the base. Remedial progress at these locations will be verified to ensure groundwater resources beneath Elmendorf AFB are cleaned within a 20-year timeline.

Glossary

Land Use Controls: Policies and procedures established to control access and exposure to the soil, air and water. Controls can be placed on one specific environmental cleanup site, on a group of sites or basewide. These can take many forms, from water use limitations, to controls on future land use.

Natural Attenuation: Natural physical, chemical and biological processes that break down contaminants in soil and water.

Operable Unit (OU): A term used to describe a certain portion or study area with an NPL site. An OU may be based upon a particular type of contaminant, contaminated media (such as soil or water), source of contamination or geographical location.

Sentinel Wells: Monitoring wells immediately north of Ship Creek and downgradient of Elmendorf AFB groundwater flow. These wells are monitored to ensure contamination is not migrating into Ship Creek.

Trichloroethene (TCE): A solvent historically used in cleaning operations.

For More Information

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